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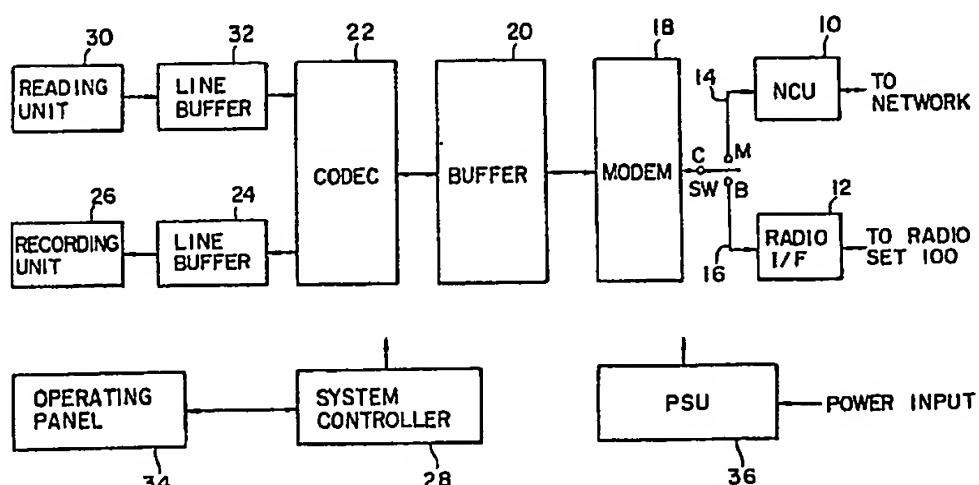
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(54) Communication control apparatus

(57) A facsimile machine includes a data processing system for processing data to be transmitted and received data according to a predetermined manner, which system typically comprises a MODEM 18, a buffer 20 and a CODEC 22. The facsimile machine includes two or more interface units 10, 12, dedicated for different types of communication networks. For example, the facsimile machine has a network control unit 10 as an interface for connection with a telephone network and a radio interface 12 for connection with a radio network. A selection switch SW is provided between the data processing system and the interface units so as to select one of the interface units to be connected to the data processing system.

Fig. 1

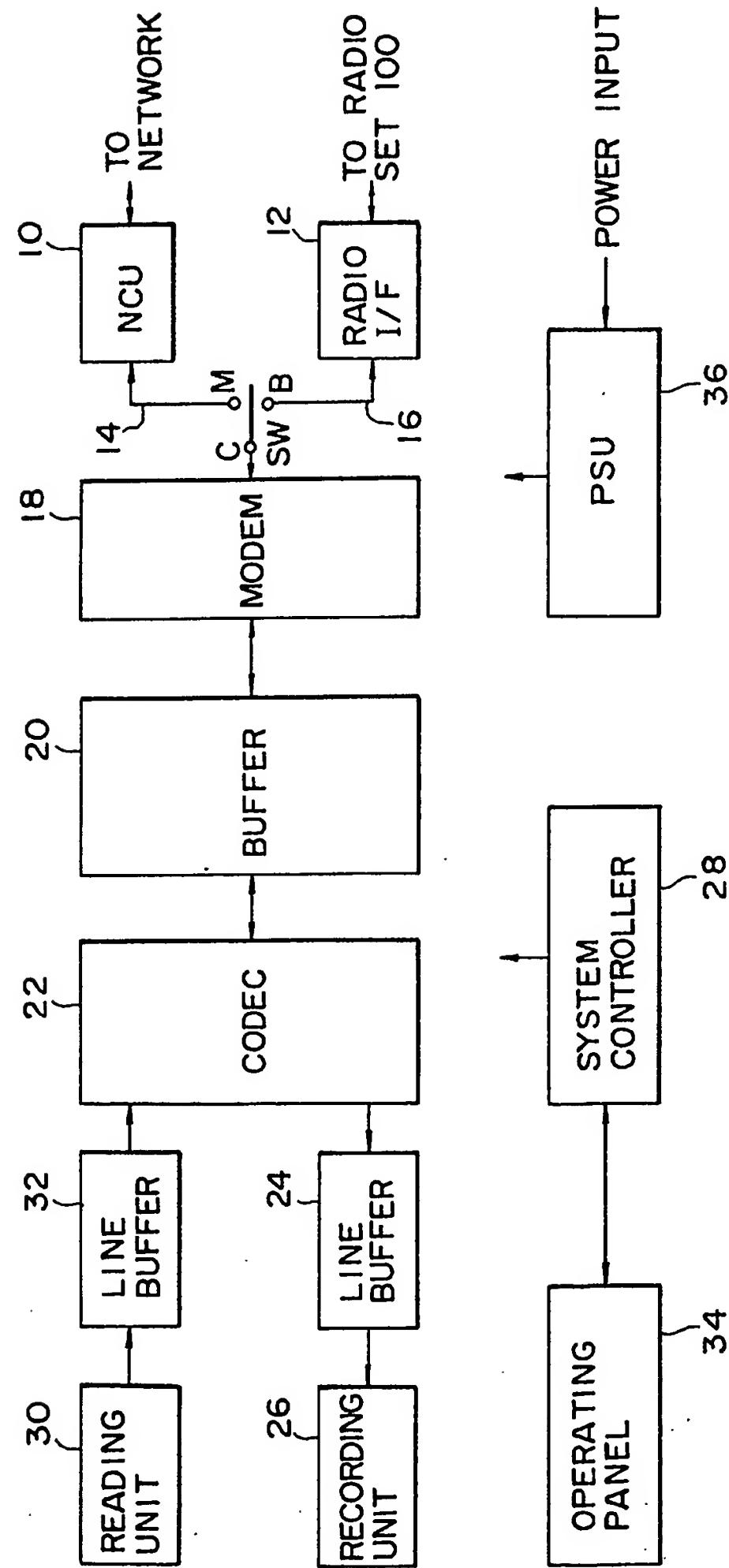


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Fig. 1



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Fig. 2

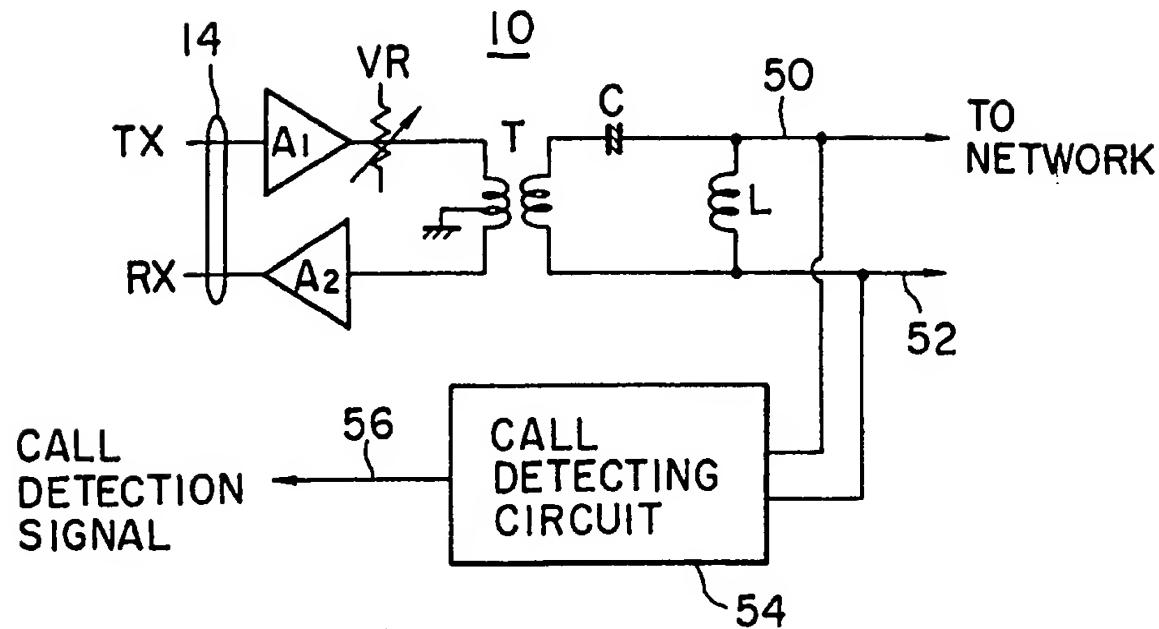
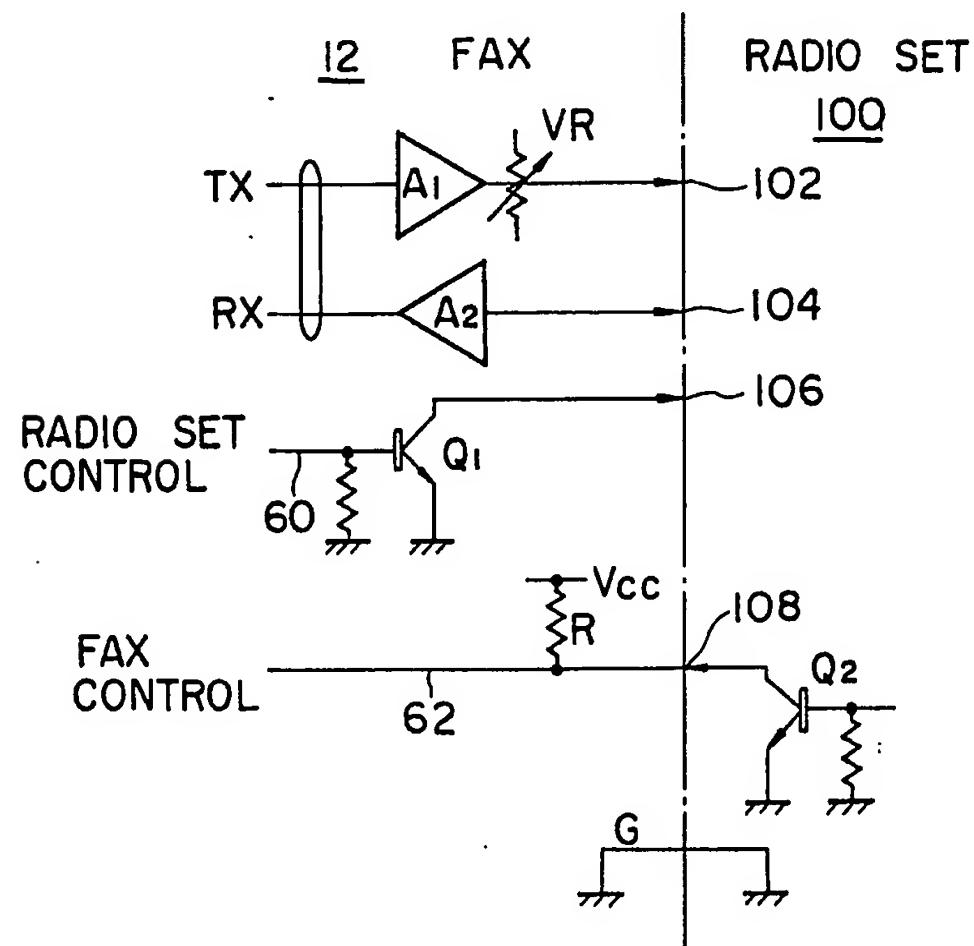


Fig. 3



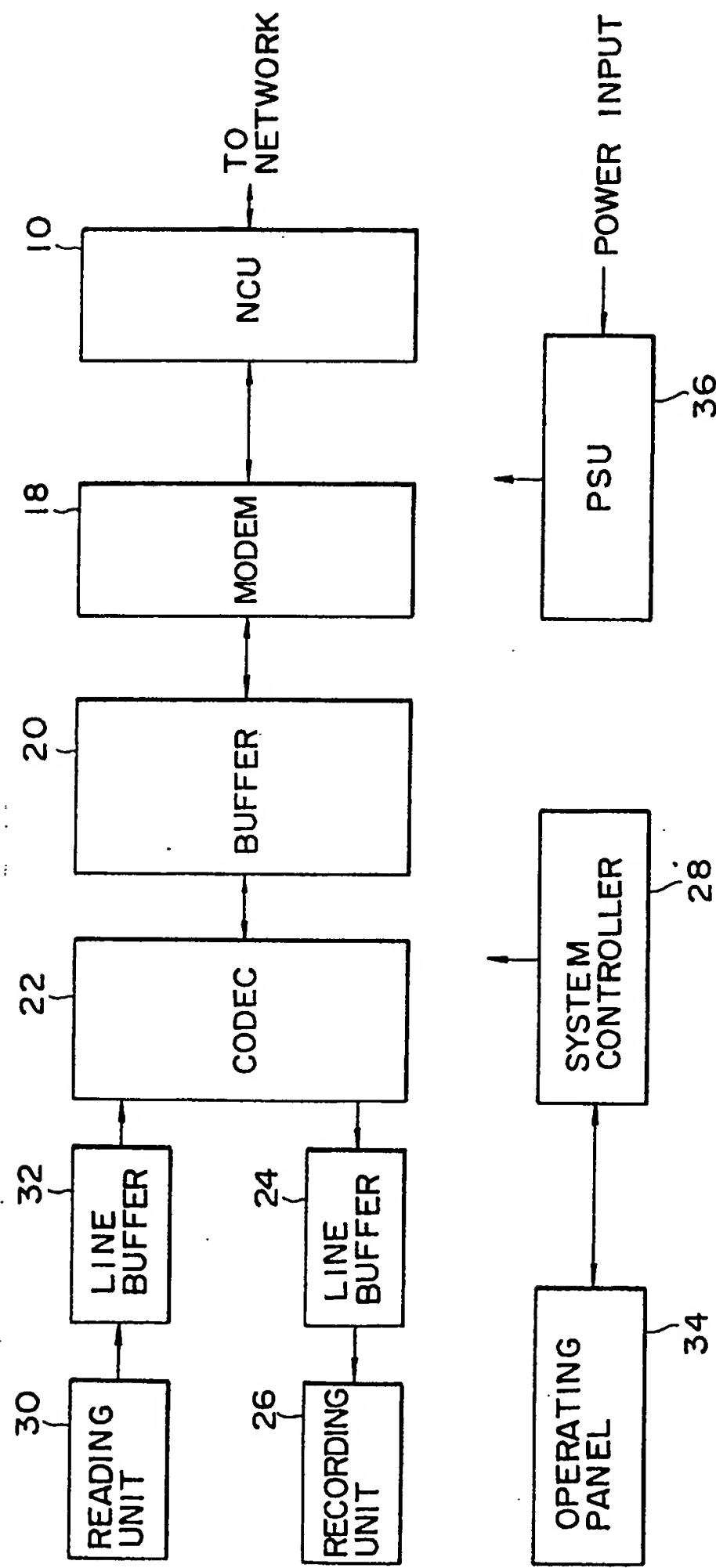
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SPECIFICATION

Communication control apparatus

5 This invention generally relates to a communication control apparatus, and, in particular, to a dual connection mode equipped communication control apparatus capable of establishing a connection with or without wire, selectively. More specifically, the present invention relates to a dual mode connectable facsimile machine which can carry out communication with or without wire, selectively.

10 A communication between two terminal stations may be carried out either by a wire communication method or a radio communication method. However, there is no data communication apparatus which can be used for either of these two different communication methods selectively. Thus, there has

15 been a need to provide a communication control apparatus which can be used for communication with or without wire, selectively.

In accordance with the present invention, there is provided a communication control apparatus which includes first interface means connected to a wire network, second interface means connected to a radio set, communication means for transmitting and receiving data, and controlling means for controlling said communication means to be connected to either one of said first and second interface means selectively. With this structure, the communication control apparatus can carry out communication either using wire network or radio network selectively. That is, the first interface means takes care of an interface between the communication means and the wire network, and the second interface is in charge of an interface between the communication means and the radio set.

It is therefore a primary object of the present invention to obviate the disadvantage of the prior art as described above and to provide a novel communication control apparatus having dual connection modes.

Another object of the present invention is to provide a communication control apparatus which allows to carry out communication using either a wire communication network or a radio communication network.

A further object of the present invention is to provide a data communication apparatus which can be used as a terminal of a wire network or a radio network selectively.

A still further object of the present invention is to provide a facsimile machine which can be used as a terminal of a wire network or a radio network.

A facsimile machine embodying the invention will now be described, by way of example only, with reference to the accompanying diagrammatic drawings, in which:

60 *Figure 1* is a functional block diagram showing the overall structure of a facsimile machine constructed in accordance with one embodiment of the present invention;

65 *Figure 2* is a circuit diagram showing the detailed structure of one embodiment of the net control unit

10 provided in the facsimile machine shown in Figure 1;

Figure 3 is a circuit diagram showing the detailed structure of one embodiment of the radio interface unit 12 provided in the facsimile machine shown in Figure 1; and

Figure 4 is a functional block diagram showing the overall structure of a typical prior art facsimile machine for use with wire communication.

75 At the outset, it is to be noted that the term "data" used in the present specification should be construed to embrace the meaning of digital data and also analog data, such as facsimile image information and audio or sound information.

80 In the case when a data communication is to be carried out using a wire communication network, such as a public telephone network, the data to be transmitted through such a wire network must be adapted to the characteristic, such as modulation to a carrier wave adaptable to a particular frequency band, of the wire network. In the case of a telephone network, this frequency band is set, for example, between approximately 300 Hz and 3 kHz. At the receiver, the data received must be demodulated before being recorded on a sheet of recording paper.

85 In the case of radiotelephony in which two-way transmission of sounds is carried out by means of modulated radio waves without interconnecting wires, a sound signal to be transmitted is input into a microphone of a radio set which converts the sound signal into an electrical signal which in turn is, for example, subjected to FM modulation so as to be adapted to a particular transmission characteristic or frequency band of the radio set before transmission of radio

90 waves into the air. In this case, also, the input voice signal is converted into a signal which is suitable for the input characteristic of the radio set and thus has an audio frequency range between approximately 300 Hz and 3 kHz.

105 As described above, for a compact communication apparatus which can be used not only as a terminal of a public telephone network, but also as a terminal of a radiotelephone network, it is advantageous to carry out input and output of data in an audio frequency band.

110 Under the circumstances, once the communication apparatus is connected to either of a wire network or a wireless network, the transmission and reception of data between the transmitter and the receiver can be carried out in the same manner using

115 the same components. Thus, there remains differences only in the structure for establishing a connection between the communication apparatus and the network depending on whether the network uses wire or not. As a result, in accordance with the principle of the present invention, there is provided a communication control apparatus including separate interface units for wire communication and wireless communication.

120 Referring now to Figure 1, there is shown in functional block form a facsimile machine which can be used for wire communications and wireless communication selectively and which is constructed in accordance with one embodiment of the present invention. As shown, the present facsimile machine includes a net control unit (NCU) 10 which has a func-

tion for establishing a connection between the present facsimile machine and a wire communication network, such as a public telephone network. In the illustrated embodiment, the net control unit 10 5 serves as an interface between the present facsimile machine and the public telephone network and thus it is equipped with functions to set up required technical conditions, physical conditions and technical standards for transmitting and receiving data 10 through the public telephone network, as well known for one skilled in the art. These conditions include input/output impedance conditions, d.c. conditions, dielectric resistance conditions and network conditions. 15 The present facsimile machine also includes a radio interface unit 12 which allows the present facsimile machine to be connected to a radio communication network through a radio set 100 (Figure 3), such as a radiotelephone. The radio set 100 may 20 be a terminal in a multichannel access (MCA) communication network, which has constraints in the length of time of usage. The radio interface unit 12 is so structured to satisfy various technical conditions, physical conditions and technical standards required 25 for connection to such a radio set 100. These conditions include input/output level conditions, input/output impedance conditions and network conditions.

An input/output line 14 extends from the network 30 control unit 10 to a contact point M of a switch SW and an input/output line 16 extends from the radio interface unit 12 to a contact point B of the switch SW. The switch SW has a movable arm pivoted at point C which is connected to a MODEM 18, which in 35 turn is connected to a CODEC 22 through a buffer 20. The MODEM 18 is a device which modulates a signal to be transmitted in accordance with a predetermined modulating method and demodulates a received signal in accordance with a predetermined 40 demodulating method. In the present embodiment, since it is so structured to be connectable to a public telephone network or a radiotelephone network selectively, the MODEM 18 has a function of modulating a facsimile data, typically image data, into a 45 signal having an audio frequency range. The buffer 20 is a memory serving to store facsimile data to be transmitted or received facsimile data temporarily.

The CODEC 22 is a device in which a facsimile signal to be transmitted is arranged in the form of a 50 predetermined frame and compressed using run-lengths according to a predetermined encoding method and a received facsimile signal is deframed and decoded to reconstruct the original facsimile signal according to a predetermined decoding 55 method. In this case, typically, a normality check of a received signal, such as a CRC check, is also carried out. In the preferred embodiment, encoding methods, decoding methods, modulating methods and demodulating methods according to the G3 60 standards of CCITT recommendations can be advantageously applied to these MODEM 18 and OCDEC 22.

The received facsimile data once stored in the buffer 20 is read out into the CODEC 22, from which the 65 data is stored into a line buffer 24. The data is then

transferred from the line buffer 24 to a recording unit 26, where the data is recorded on a sheet of recording medium. The recording unit 26, for example, includes a thermal printhead comprised of a plurality 70 of heat-producing elements arranged in the form of an array, a laser printer or any other desired devices. Although such a mechanism as a transport control unit for the sheet of recording medium is not shown, its movement is for example controlled by a pulse 75 motor under the control of a system controller 28. Of course, the recording unit 26 may also include an image displaying device, such as a CRT, if desired. On the other hand, facsimile data to be transmitted is obtained by optically reading an original document in the form of raster scanning by a reading unit 30 including, for example, an image sensor comprised of a plurality of photoelectric elements arranged in the form of an array. The facsimile data thus obtained is then converted into a binary image signal 80 by a thresholding operation, and the thus converted binary image signal is then stored into a line buffer 32. The facsimile data is then transferred to the buffer 20 through the CODEC 22, where the facsimile data is compressed by encoding. 85 The functions and operations of the various components of the present facsimile machine described above are integrally controlled by a system controller 28 which is preferably comprised of a microprocessor. The system controller 28 is in charge of 90 various controls required for the operation of the present facsimile machine, such as data control and communication procedure control, as well as the controls of various components of the present facsimile machine. Since the present machine is so 95 structured to be capable of carrying out both of wire and wireless communications, the system controller 28 is provided with control functions required for such both of communication methods in the form of software. 100 Connected to the system controller 28 is an operating panel 34 which is typically provided with various keys and buttons, which are operated by the operator, and indicators or display units, indicating the 105 status of the machine and the network. A power supply unit (PSU) 36 is also provided in the present facsimile machine for supplying power to the above-described various components. It is to be noted that 110 control lines extending among the system controller 28, the power supply unit 36 and various other components are omitted from Figure 1 so as to avoid crowding of the figure. The switch SW in the present embodiment has a function of selecting a wire communication mode using the telephone network through the net control 115 unit 10, or a wireless communication mode using the radio set 100 through the radio interface unit 12. The status of the switch SW is determined by operating a corresponding button on the operating panel 34. It is to be noted that a transmission signal TX and a reception signal RX are mainly transmitted through the switch SW and the switch SW is shown in Figure 1 to 120 represent switching between transmission mode and reception mode by a single switch conceptually. It may also be so structured that various signals required for the interface units 10 and 12 are transferred 125 130

red through the switch SW. Besides, the switch SW is preferably comprised of an electronics switch.

When the wire communication mode is selected by operating the operating panel 34, the system controller 28 responds to this selection and causes the switch SW to be connected to the contact point M, so

5 that the network control unit 10 is connected to the MODEM 18. On the other hand, if the wireless or radio communication mode is selected by operating 10 the operating panel 34, the system controller 28 responds to this selection and causes the switch SW to be connected to the contact point B, thereby establishing a connection between the radio interface unit 12 and the MODEM 18.

15 Referring now to Figure 2, the detailed structure of one embodiment of the net control unit 10 is shown. A transmission signal TX and a reception signal RX on the signal line 14 is input into and output from the net control unit 10, respectively. These signals TX 20 and RX are coupled to a facsimile side winding of a hybrid transformer T through amplifiers A1 and A2 and a variable resistor VR. The transformer T has a network side winding which is connected to a series connection including a d.c. component removing 25 capacitor C and a coil L providing a d.c. holding function. A pair of network terminals 50 and 52, each connected at the corresponding end of the coil L, is provided and a public telephone network is connected thereto. These hybrid transformer T, capacitor C and 30 coil L are so structured to satisfy the technical standards of the public telephone network in the present embodiment.

The transmission signal TX is amplified to a predetermined level by the amplifier A1 and, after having 35 been adjusted to an appropriate level by the variable resistor VR, input into the transformer T, from where the signal is transferred to the network. The signal from the amplifier A1 is not input into the other amplifier A2 substantially or at all. On the other 40 hand, a signal from the network is processed through the transformer T and then through the amplifier A2 to be output as a reception signal RX having a predetermined level. It should also be noted that, in addition to the transmission and reception 45 signals TX and RX, respectively, unique control signals required for communication through the telephone network are also exchanged between the network control unit 10 and the system controller 28.

Also provided is a call detecting unit 54 as connected 50 to the pair of network terminals 50 and 52 and it detects a call or ringing signal supplied from the transmitter or the central station of the network. As well known in the art, the call signal is an a.c. signal for exciting a buzzer of a telephone receiver. In the 55 case of a telephone receiver, communication can be made by lifting a receiver to establish an off-hook condition. In the case of a facsimile machine, this call signal is used as a control signal for detection of a call. In the present embodiment, an output signal 56 from the call detecting circuit 54 is supplied to the system controller 28 as a call detection signal. In response to this call detection signal, the system controller 28 carries out an automatic call control procedure, i.e., a control procedure for establishing 60 connection to the facsimile machine. It should be

noted that the net control unit 10 includes all of the functions necessary for controlling communication using the public telephone network, but those portions which are not necessary for understanding the 70 principle of the present invention have been omitted for the sake of brevity.

Referring now to Figure 3, the detailed structure of one embodiment of the radio interface unit 12 is shown. As shown, a transmission signal TX and a 75 reception signal RX on the signal line 16 is input into and output from the radio interface unit 12 through the switch SW, respectively. The transmission signal TX is coupled to a microphone input terminal 102 of the radio set 100 through an amplifier A1 and a variable resistor VR. This transmission signal TX is amplified to a predetermined level by the amplifier A1 and adjusted to a level suitable for input into a microphone when output from the radio interface unit 12. On the other hand, a signal received by the 80 radio set 100 is adjusted in level suitable for input into the radio interface unit 12 and input into an amplifier A2 from an output terminal 104 of the radio set 100. This signal is amplified by the amplifier A2 to a signal level suitable for the present facsimile 85 machine or its impedance is matched, and it is output onto the signal line 16 as a reception signal RX. It should also be noted that, in addition to the transmission and reception signals TX and RX, unique control signals necessary for communication 90 using the radio set 100 are exchanged between the radio interface unit 12 and the system controller 28.

A radio set control signal from the system controller 28 is coupled to a control line 60 and supplied to a control input terminal 106 of the radio set 100 100 through a transistor Q1. This signal serves to apply a low level signal to the control input terminal 106 of the radio set 100 by rendering the transistor Q1 conductive during a time period in which the transmission signal TX is transmitted from the present facsimile machine. In the present embodiment, the radio set 100 is normally in the receiving mode, but it is set in the transmission mode only when a low level signal is applied to the control input terminal 106. Thus, when the system controller 28 supplies a high 105 level radio set control signal to the control line 60, the radio set 100 is set in the transmission mode, and during a time period in which the control signal is at high level, the transmission signal TX is supplied to the signal line 16 after originating from the reading 110 unit 30 and being processed through those elements, including CODEC 22, MODEM 18 and switch SW.

A fax control signal is supplied from an output terminal 108 of the radio set 100 to the radio interface 115 unit 12. This signal corresponds to the before-mentioned call detection signal in the net control unit 10, and thus the output terminal 108 is activated when a call has been placed to the present facsimile machine from another station. This fax control signal 120 is supplied to the system controller 28 via a control line 62 of the radio interface unit 12, and, in response thereto, the system controller 28 carries out an automatic call processing procedure.

The above-described embodiment has typical 125 functions required for wire and wireless communication

modes. There may be a case, however, which requires unique control signals depending on the type of communication. In order to cope with such a case, it is preferable that the system controller 28 be structured to contain an interface for handling such unique control signals and software therefor in advance if it is known previously. In this manner, in accordance with the principle of the present invention, the same communication apparatus can be used commonly for different modes of communication simply by providing an interface unit dedicated for a particular mode of communication and its associated software.

For this purpose of comparison with the present invention, Figure 4 shows the overall structure of a typical prior art facsimile machine. In Figure 4, those elements corresponding to those shown in Figure 1 are indicated by identical numerals. This prior art facsimile machine is structured to be exclusively connected to a public telephone network, and thus its MODEM 18 is fixedly connected to its network control unit 10 as different from the present invention as described above. As can be understood from this comparison, in accordance with the present invention, data processing components, such as recording unit 26, OCDEC 22 and MODEM 18, other than an interface unit in charge of establishing connection between the communication unit and a particular communication network are shared and commonly used. Thus, even if the communication apparatus is structured to be applicable to two or more different modes of communication, such as wire communication and wireless communication, the overall structure of the communication apparatus can be maintained compact in size and low at cost. It is to be noted that the present invention is applicable to any type of data communication apparatus other than a facsimile machine described above.

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CLAIMS

1. A communication control apparatus comprising:
45 first interface means connectable to a first communication network;
second interface means connectable to a second communication network which is different from said first communication network in mode of communication;
50 processing means for processing data to be transmitted or data received in accordance with a predetermined procedure through said first and second interface means;
55 selecting means for selecting one of said first and second interface means to be operatively connected to said processing means; and
controlling means for controlling the overall operation of said apparatus, said controlling means sup-
60 porting a selection signal to said selecting means
thereby causing said selecting means to select one of said first and second interface means to be connected to said processing means.
2. Apparatus of Claim 1 wherein said first communication network is a wire communication net-
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work and said second network is a wireless communication network.

3. Apparatus of Claim 2 wherein said wire communication network is a telephone network and said wireless communication network is a radiotelephone network.
4. Apparatus of Claim 1 wherein said processing means includes a MODEM for modulating data to be transmitted through a selected one of said first and second interface means and demodulating data received through a selected one of said first and second interface means.
5. Apparatus of Claim 4 wherein said processing means further includes a CODEC for encoding or decoding said data in accordance with a predetermined manner.
6. Apparatus of Claim 5 wherein said processing means further includes optical reading means for optically reading an original document to obtain image data to be transmitted.
7. Apparatus of Claim 6 wherein said processing means further includes recording means for recording said received data on a recording medium.
8. Apparatus of Claim 1 wherein said controlling means includes an operating unit which is operated by an operator to provide an instruction for selecting one of said first and second interface means.
9. A communication control apparatus substantially as herein described with reference to the accompanying drawings.

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